REMARKS

Introduction

In response to the Office Action dated August 18, 2007, Applicants have amended claims 2 and 6. Claims 8-17 have been added. Support for amended claim 2 is found in, for example, pg. 13, lines 5-18. Claim 6 has been amended to depend from claim 1. Support for new claims 8 and 17 is found in, for example, pg. 8, lines 19-21. Support for new claims 9 and 10 is found in, for example, Table 4. Support for new claim 11 is found in, for example, pg. 20, lines 4-8; and pg. 6, lines 11-15. Support for new claim 12 is found in, for example, pg. 7, lines 1-2. Support for new claims 13 and 14 is found in, for example, pg. 7, lines 4-10. Support for new claim 15 is found in, for example, pg. 7, lines 15-18. Support for new claim 16 is found in, for example, pg. 9, lines 11-14. Care has been taken to avoid the introduction of new matter. In view of the foregoing amendments and the following remarks, Applicants respectfully submit that all pending claims are in condition for allowance.

Claim Rejection Under 35 U.S.C. § 103

Claims 1-7 stand rejected under 35 U.S.C. § 103 (a) as being unpatentable over Japanese Patent Publication No. 06-237018 (hereinafter JP '018). The Office Action asserts that JP '018 teaches a method of production of a thermoelectric material with a density of 95% or more of the theoretical density through compressing fine powder at between 0.5 and 3 GPa.

Turning to the prior art, JP '018 describes producing thermoelectric material through compressing powder having a grain size of 74-297 micrometers that is heated with the application of pressure of 1 GPa (*see,* Para. [0014]). The grain size of 74-297 μm of JP '018 is equivalent to 74,000 – 297,000 nm, which is <u>not</u> at most 50 nm.

JP '018 fails to disclose or suggest, at a minimum, "...a thermoelectric material having an average crystal particle size of **at most 50 nm** and having a relative density of at least 85 %," as recited in claim 1.

According to the claimed subject matter per claim 1, a thermoelectric material having an average crystal particle size of **at most 50 nm**. Thereby, as taught in the instant specification, the smaller the average particle size of the thermoelectric material is, the lower the thermal conductivity of the thermoelectric material (*see, e.g.,* Table I; pg. 2, line 1-pg. 3, line 4; and pg. 7, lines 14-21). The performance of the thermoelectric material is measured by a thermoelectric figure of merit, which is represented by the following formula: $Z = S^2 / (\rho \bullet \kappa)$ where S is the Seebeck coefficient (V/K), ρ is the electrical resistivity (Ωm), and κ is the thermal conductivity (W/mK). As a result, the thermal conductivity of the claimed thermoelectric material is approximately five times larger than JP '018. Thus, the thermal conductivity of the claimed thermoelectric material is about one-fifth the value of the thermal conductivity of JP '018. However, JP '018 does not disclose or suggest this, and apparently is unaware of the unexpected improvement in decreasing the thermal conductivity made possible by the claimed thermoelectric material.

Further, JP '018 does not recognize the relationship between impurities and the claimed thermoelectric material.

When the content of impurities is controlled, the maximum detected intensity of an element among constituent elements of the thermoelectric material is improved, as required by dependent claims 2 and 11. When impurities peak, an O-peak intensity measured by EDS analysis is at most one-fifth of a maximum intensity of an element among constituent elements for the claimed thermoelectric material (*see, e.g.,* pg. 13, lines 5-18; Table 2). JP '018 does not

disclose or suggest this, and does not appreciate the unexpected improvement in reducing the electrical resistivity in order to improve the thermoelectric performance provided by the claimed thermoelectric material.

JP '018 fails to disclose or suggest, "...impurity elements have a detected intensity of at most one-fifth of a maximum detected intensity of an element among constituent elements of said thermoelectric material, as determined by EDS analysis of a grain boundary portion of said thermoelectric material," as recited by dependent claims 2 and 11.

Dependent claims 3-10 and 12-17 are allowable at least for the same reasons as independent claim 1, and further distinguish the claimed thermoelectric material.

New Claims

New claim 9 recites in part, "...thermoelectric material comprises a composition of at least one of Fe, Zn, Co, Mg, Mn, Zr and Ni and at least one of Si, O, Sb and Sn, or a mixture of at least two of said compositions." Nothing in the cited reference teaches or suggests the described subject matter. Additionally, dependent claims 8 and 10-17 recite patentably distinguishing features of their own. It is submitted that these new claims are distinguishable over the cited reference.

Conclusion

In view of the above amendments and remarks, Applicants submit that this application should be allowed and the case passed to issue. If there are any questions regarding this Amendment or the application in general, a telephone call to the undersigned would be appreciated to expedite the prosecution of the application.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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